IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent application of:

Applicant(s): Michael Hannington
Serial No: 09/742,654
Filing Date: December 21, 2000
Title: ADHESIVE ARTICLES WITH IMPROVED AIR EGRESS
Examiner: Victor S. Chang
Art Unit: 1771
Docket No. AVERP2850US

DECLARATION UNDER 37 C.F.R. §1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Michael Hannington, declare that:

1. I am the applicant of the above-identified patent application, and the inventor of the subject matter described and claimed in said patent application.

2. I am a Research Associate for the Reflective Films Division of the Avery Dennison Corporation and have been employed by Avery Dennison since January of 1983. I have more than thirty years of experience in the field of heat activated and pressure sensitive adhesives.

3. I have reviewed the Examiner's comments in the Office Action of January 23, 2003 with regard to the characterization of the adhesive of the invention as being a "not fully cured" pressure sensitive adhesive.

4. The adhesives suitable for use in the adhesive article of the invention are not limited to pressure sensitive adhesives. While I have included a release liner in at least one embodiment of the invention, even this embodiment is not limited to a pressure sensitive adhesive. In my experience, heat activated adhesives are routinely used with release liners. The Reflective Division of Avery Dennison presently has in commerce multiple products that include a heat activated adhesive with a release liner. A release liner is used to releasably adhere to the heat activated adhesive during processing, converting, storage and shipping of the adhesive product. The release liner is typically not removed until just prior to application of the product. Heat activated

adhesives typically have slight tack at room temperature, become tacky at temperatures well below their melting points and require a release liner to prevent blocking of the product at normal storage and handling temperatures.

5. Pressure sensitive adhesives, as used by the consumer, are typically fully cured systems, whose properties are inherent to the particular material selected to compound them. Pressure sensitive adhesives possess a balance of the conflicting properties of tack and cohesive strength. Cohesive strength is the property of the adhesive to hold together. In Alphonsus V. Pocius, *Adhesion and Adhesives Technology*, Hanser/Gardner Publications (1997), this balance of properties is discussed:

> The property we first notice about PSA's is their tack. We know what tack feels like, but how do we describe it and, for that matter, how do we generate materials with tack? Tack is generated by adding certain low molecular weight materials to elastomers in a process called tackification. These tackifiers, because of their low molecular weight, decrease the cohesive strength of the elastomer. However a PSA must have tack and sufficient cohesive strength to hold two things together. In this section, we see how a balance of properties is generated so that a PSA combines these seemingly mutually exclusive properties to yield a materials with "sufficient ability to hold onto the adherend" as well as "be cleanly removed from the adherend".
> (Page 217)

> When a pressure-sensitive tape is applied to a substrate, the adhesive is expected to spontaneously spread on the surface with little or no applied pressure. That is, the PSA is expected to act like a liquid. However, when the adhesive is peeled or a weight is hung from it, we expect the adhesive to resist the force. That is, it should act as a solid. This contradictory behavior is available from viscoelastic materials. . . A PSA tape is not applied to a substrate rapidly. In fact, the tape is often allowed to sit on the surface for a while after application. Thus, the time scale of application is long, usually on the order of a second or more.
> (Page 229-230)

6. Attached is a table from the reference cited above that lists the cure or application conditions for various types of adhesives. The necessary conditions listed for pressure-sensitive adhesives is "None, just finger pressure." It is therefore, well

known that pressure sensitive adhesives are fully cured at the time of application and capable of forming an adhesive bond without further curing.

7. While a pressure sensitive adhesive has initial tack, the bond between the adhesive and the surface to which it is adhered typically increases over time. In I. Benedek and L.J. Heymans, *Pressure Sensitive Adhesive Technology*, Marcel Dekker, Inc. (1997), the process of bond formation is discussed:

> During bond formation contact on a molecular dimension between the adhesive and the adherent is established, in isolated points of geometric contact area, the number and size of which increase with the contact time through deformation and flow, as well as by wetting.
> (Page 75)

8. The adhesives used in the invention are deformed when the non-adhesive material forms are embedded into the adhesive surface. The non-adhesive material helps to sustain the deformation. Because the non-adhesive material forms are applied in a pattern having a path of air egress to the end edges of the adhesive article, trapped air bubbles can be removed by applying finger pressure to the bubble to push it out to the end edges through the channels created by the embedded non-adhesive material forms.

9. To illustrate the mechanism by which the adhesive article of claims 1-26 functions to permit air egress of trapped air from the interface between the adhesive and the substrate to which the adhesive article is attached, I offer the following:

In the case of a standard adhesive tape, having no means of air egress, an air bubble is formed between the adhesive and the substrate by lightly placing a piece of the tape on the surface of the substrate and applying finger pressure to press the adhesive to the substrate in a pattern of a circle (or other "enclosed" area). To remove the air bubble, pressure is applied with enough force to break through the facestock of the tape, or to break through the adhesive/substrate interface at the periphery of the tape. In either event, the air is removed through the path of least resistance.

The adhesive article of claim 1-26 provides a built-in path of least resistance. The pattern of non-adhesive material forms embedded into the adhesive at the interface between the adhesive and the facestock provides a path of air egress, or path of least resistance, to the end edges of the article. To remove an air bubble trapped between the adhesive and the substrate to which it is applied at the adhesive/substrate interface, light finger pressure is applied to the air bubble, which causes the adhesive to "dome up" into the channels created by the embedded non-adhesive material forms, which in turn, causes the channel to fully or partially collapse. The air in the pattern of channels is exhausted through the channels to an outside edge. When the pattern of channels collapses, it leaves a complimentary pattern, or

"path of least resistance" at the adhesive/substrate interface, allowing the trapped air to be moved to the end edges of the adhesive article.

The pattern of non-adhesive material forms create a path of weakness at the adhesive/substrate interface. When the adhesive article is applied to a substrate, air trapped between the adhesive and the substrate follows the path of least resistance, which is the area of least geometric contact, referred to above in the citation of Benedek et al. This is the mechanism by which the trapped air forces the adhesive into the channels of the embedded pattern, creating a path of air egress for the trapped air.

10. Even with modest application of pressure, the combination of geometric contact area of the adhesive and the viscoelastic properties of the adhesive allows the adhesive to debond readily under the pattern of non-adhesive material forms, e.g., the path of weakness, to form a path of air egress at the adhesive/substrate interface.

11. I am not familiar with the reference, "Polymer Interface and Adhesion, S. Wu, p.359" cited by the Examiner, nor was I able to locate a copy of this reference. However, based upon my experience and a review of the excerpt reproduced by the Examiner, it appears that the reference refers to liquid adhesives that require a curing step at application, rather than pressure sensitive adhesives that require no curing at application.

All statements here made are true and accurate to the best of my knowledge and belief and with the knowledge that willful false statements and the like are punishable by fine or imprisonment or both under 18 U.S.C. §1001.

Date: 7-22-03

Michael Hannington